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**Description**

**Fibre guide channel for an open end spinning device and a method for producing a fibre guide channel**

The invention relates to a fibre guide channel according to the preamble of claim 1 and a method for producing a fibre guide channel according to the preamble of claim 4.

Fibre guide channels have been known for a long time in conjunction with open end spinning devices, in particular with open end rotor spinning devices and are described in numerous patent applications.

High demands are made of the design of fibre guide channels of this type, in which a pneumatic transportation of individual fibres takes place, in particular with regard to the geometric configuration and the surface quality. In other words, the flow conditions inside a fibre guide channel of this type must ensure that the fibres as far as possible remain drawn or are drawn during transportation. In addition, the surface of these components has to be continuously smooth, so that during pneumatic transportation of the fibres, no fibres can become fixed. Damaging air eddies being able to form in the boundary layer region of the fibre guide channel should be avoided, in particular, here.

With regard to the production of fibre guide channels of this type, various manufacturing methods have also been known for a long time.

Fibre guide channels, which are completely or partially manufactured from steel sheet parts, are described, for example, in DE-AS 23 64 261, DE-OS 28 00 795 or DE 195 11 084 A1.

According to DE 28 00 795 A1 it is provided, for example, that a fibre guide channel mechanism is produced initially in a first working step from a steel sheet. This pre-manufactured component then has liquid aluminium, for example, cast round it in a pressure casting mould. This production method has not, however, found a way into practice as the problems occurring could not be satisfactorily solved. It had been found, for example, that the fibre guide channel mechanism pre-manufactured from steel sheet deforms in the pressure casting mould owing to the high pressure and therefore has to be laboriously supported. Moreover, in this production method, there is constantly the risk of excess casting material penetrating into the fibre channel and this has a negative effect on the surface quality thereof.

The fibre guide channel mechanism according to DE 195 11 084 A1 is also configured as a cold-formed steel sheet part. In this mechanism, however, the steel sheet part can be fixed, so as to be replaceable, in a corresponding receiving hole of a pre-manufactured opening cylinder housing and sealed relative to the opening cylinder housing by an O-ring seal resting on the outer periphery of the fibre guide channel mechanism.

Compared to the channel plate, this known fibre guide channel mechanism is sealed by means of a special hose nozzle. However, it has been found in practice that sealing problems

can occur, which do not allow proper spinning operation, in steel sheet constructions of this type.

Furthermore, fibre guide channels, which are configured as pressure cast parts, are described in DE 197 12 881 A1. These known fibre guide channels have a foot part with a centring mechanism and an annular groove for receiving a sealing ring and can be fixed at a precise angle and in an air-tight manner via this foot part in a corresponding hole of the opening cylinder housing. The fibre guide channel opens in the region of a central channel plate adapter receiver in a hole, this region also being sealed in an air-tight manner via a corresponding seal. The fibre guide channels according to DE 197 12 881 A1 are also provided with wear protection, for example by immersion in a nickel dispersion bath.

The above-described fibre guide channels have succeeded, in principle, in practice and are used in large numbers in open end rotor spinning devices. However, the production of fibre guide channels of this type as a zinc or aluminium pressure casting is very expensive and leads to permanently high mould costs. Moreover, in this manufacturing method, the reject quota is relatively high, in particular owing to the high quality demands on the surface quality of the fibre guide channels.

Proceeding from the aforementioned prior art, the invention is based on the object of developing a fibre guide channel and a method for producing fibre guide channels, which allows economical manufacture, i.e. manufacture which is as low as possible in rejects, of fibre guide channels, in which limits

which are too narrow should not be set either with regard to the shaping of the fibre guide channels.

This object is achieved according to the invention by a fibre guide channel as described in claim 1.

A preferred method for producing a fibre guide channel of this type is described in claim 4.

Advantageous configurations of the method according to the invention are the subject of claims 5 to 9.

The fibre guide channels according to the invention, in particular, have the advantage that they are substantially free of procedural restrictions with regard to the outer and inner form. In other words, the fibre guide channels are hardly subjected to any restrictions with regard to their shaping even in the region of their internal cross-section and can easily be provided with a channel profile which is optimised in terms of flow. As the reject quota is extremely low in the production method provided, economical manufacturing of fibre guide channels of this type is also possible.

The final bodies produced after sintering can be subjected, in this case, virtually without further finishing in subsequent finishing processes, to virtually any conceivable heat treatment and surface treatment methods. In other words, because in fibre guide channels, which are produced by the above-described manufacturing method, a large part of the otherwise conventional, relatively expensive finishing work is dispensed with and the reject quota is very low, the fibre

guide channels according to the invention can be manufactured without many process steps and therefore economically and with a high quality.

A corresponding method is also called MIM or PIM technology (Metal Injection Moulding - MIM or Powder Injection Moulding = PIM). To produce fibre guide channels by MIM or PIM technology, initially an organic binder is mixed with a sinterable material, for example a very fine (< 20 μm), generally spherical metal powder or an oxide ceramic powder to form a homogeneous mass or processed to form so-called pellets. The volume portion of the metal powder or of the oxide ceramic powder in this homogeneous mass is generally over 50% in this case. The mass obtained is then handled similarly to plastic material processing on injection moulding machines. In other words, blank bodies are manufactured from this mass by means of an injection moulding machine and already have all the typical geometric features of the fibre guide channel to be produced, but still possess a volume which is enlarged by the binder content. The organic binders are then removed from the blank bodies in a so-called binder removal process. The remaining porous intermediate bodies are then compacted by sintering in various protective gasses or a vacuum to form fibre guide channels with the final dimensions. The shrinkage occurring in this case can lead to final sizes greater than 96%.

Basically, in the use of MIM or PIM technology there is also the possibility of influencing the inner contour or the internal width of the fibre guide channels by targeted mass concentration, for example. In other words, the shrinkage behaviour of the blank body can be controlled by reinforced,

outer mass application in certain regions of the fibre guide channel and therefore, for example, the demoulding slopes produced during production of the blank body, can be counteracted.

Owing to the material of the sinterable material, for example metal power or oxide ceramic powder, the grain size of the sinterable material and the selection of the binder removal and/or sintering parameters, the surface structure of the fibre guide channel can be influenced in a targeted manner. In other words, the most favourable surface structure for further processing or heat treatment can already be fixed in advance.

In the used of the above-described method, there is obviously the possibility of configuring the fibre guide channels either in one part or else so as to be multi-part.

In a multi-part configuration, it is advantageous if at least one insertion piece which is arranged in the region of the inlet opening of the fibre guide channel and forms the fibre tear-off edge and therefore is subjected to high loading, is produced by MIM or PIM technology, as an insertion piece produced in this manner is already very wear-resistant and can then be still further improved without problems by corresponding finishing. In other words, in fibre guide channels produced by MIM or PIM technology, the so-called eggshell effect (= hard shell but soft core) is avoided. The components produced have a continuously high wear-resistance. The surfaces which come into contact with the fibres can be additionally improved in this case in a relatively simple manner, for example by chrome plating.

In the case of one-part fibre guide channels, the surface quality of the fibre guide channel, in particular, can be optimised in a relatively simple manner by chrome plating or the like. In other words, a very smooth surface of the fibre guide channel can be produced by a corresponding coating and this has a very positive effect on the flow conditions inside the fibre guide channel and therefore, as a whole, on the spinning result of the entire mechanism.

The fibre guide channels manufactured according to the invention or the insertion pieces may advantageously also be subjected to another heat treatment known *per se*, for example nitration, boration, etc. Heat-treated components of this type are distinguished by a long service life.

The invention will be described in more detail hereinafter with the aid of an embodiment shown in the drawings, in which:

Fig. 1 schematically shows a side view of an open end rotor spinning device with a fibre guide channel according to the invention connected between the opening cylinder housing and spinning rotor.

Fig. 2 shows a front view of an opening cylinder housing with a first embodiment of a one-part fibre guide channel manufactured by MIM or PIM technology,

Fig. 3 shows a side view of the fibre guide channel shown in Fig. 2

Fig. 4 shows a second embodiment of a one-part fibre guide channel manufactured by MIM or PIM technology,

Fig. 5 shows a multi-part fibre guide channel comprising an insertion piece manufactured by MIM or PIM technology.

The open end rotor spinning device 1 shown in Fig. 1, as known, has a rotor housing 2 in which a spinning rotor 3 runs at a high speed. The spinning rotor 3 is supported in this case with its rotor shaft 4 in the interspace of a support disc bearing 5 and is loaded by a tangential belt 6 along the length of the machine, which is engaged by a pressure roller 7. The rotor housing 2 which is *per se* open toward the front, is closed during operation by means of a pivotably mounted cover element 8, which has a channel plate 37 with a seal 9 and connected via a corresponding pneumatic line 10 to a negative pressure source 11, which generates the necessary negative spinning pressure in the rotor housing 2. In a receiving opening, not shown in more detail, of the channel plate 37 there is arranged a preferably replaceable channel plate continuation, a so-called channel plate adapter 12, which has a thread take-off nozzle and the orifice region of a fibre guide channel 13.

Fixed to the cover element 8, which is mounted so as to be rotatable to the limited extent about a pivot pin 16, is an opening cylinder housing 17. The cover element 8 also has rear bearing brackets 19, 20 for mounting an opening cylinder 21 or a fibre band take-in cylinder 22. The opening cylinder 21 is driven in the region of its wharve 23 by a peripheral tangential belt 24 along the length of the machine, while the drive of the fibre band take-cylinder 22 is preferably implemented via  worm gear arrangement (not shown), which is connected on a drive shaft 25 along the length of the machine.

Fig. 2 shows the opening cylinder housing 17 in a front view, partially in section. A one-part fibre guide channel 13, which was produced by MIM or PIM technology is positioned in a connection hole 31 of the opening cylinder housing 17. As shown, the connection hole 31 has a stop step 32, on which the fibre guide channel 13 is supported in the installed state. The connection hole 31 furthermore has a lateral recess 33, in which a position fixing mechanism 34 arranged on the fibre guide channel 13 engages. The fibre guide channel 13 is sealed with respect to the connection hole 31 of the opening roller housing 17 by an O-ring seal 35, which is positioned in a corresponding groove 36, which is arranged in the fibre guide channel foot 44.

The fibre guide channel 13 is sealed with respect to the channel plate 37, for example, via a hose nozzle 38, which is supported on a contact shoulder 41 on the fibre guide channel 13.

The fibre guide channel 13 produced by MIM or PIM technology and shown in a front view in Fig. 2 is shown in a side view in Fig. 3. The fibre guide channel 13 preferably has, as already mentioned above, a foot part 44 which is circular in cross-section, seen in plan view, a partially conically extending central section 45 and a cylindrical orifice region 46. A groove 36 is arranged to receive an O-ring seal 35 in the foot part 44. In addition, the foot part 44 has a concave rounded part 47 adapted to the opening cylinder 21. The rounded part 47 extends here from a fibre tear-off edge 50 in the rotational direction of the opening cylinder 21. The fibre guide channel 13, in the region of the fibre tear-off edge 50,

in other words in its inlet region 18, has an internal channel cross-section with a width/height ratio of about 3:1 and runs, in relation to its width B, toward its orifice 26, preferably at an angle $\alpha$.

As can be seen from Fig. 2, the height H of the fibre guide channel 13, on the other hand, from its inlet region 18 to its orifice 26, remains substantially constant.

Fig. 4 shows a further embodiment of a one-part fibre guide channel 13. As indicated, the fibre guide channel 13 has, in the region of its inlet opening 18, a narrow point 15, which restricts the internal cross-section of the fibre guide channel 13 with respect to its height H. The flow speed of the transporting air flow can be increased in the region of the inlet opening by means of an embodiment of this type of a fibre guide channel.

An increase of this type in the flow speed of the transporting air flow in the region of the inlet opening can also be achieved by the use of a multi-part fibre guide channel 13 shown in Fig. 5. In an embodiment of this type, an insertion piece 27 is arranged so as to be replaceable in the region of the inlet opening 18 of the fibre guide channel 13. At least the insertion piece 27 is manufactured here by MIM or PIM technology. The replaceable insertion piece 27, which reduces the internal cross-section of the fibre guide channel 13 significantly in this region, in the installed state, is supported on the stop step 32 of the receiving hole 31 of the opening cylinder housing 17. The insertion piece 27, as indicated above, produces a reduction in the inlet opening 18 of the fibre guide channel 13 and therefore an acceleration of

the transporting air flow entering the fibre guide channel 13 and active because of the negative pressure in the rotor housing.

In a further embodiment (not shown), the insertion piece 27 may obviously also be configured such that the internal cross-section of the fibre guide channel 13 is not constricted. At least the insertion piece 27 is also manufactured by MIM or PIM technology in a multi-part fibre guide channel 13 of this type.